National Bur of Standards

Quarterly Status Report

Vacuum Ultraviolet Spectra of
Atoms and Light Molecules

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1. Work on the interpretation of the high-resolution absorption spectrum of carbon monoxide in the vacuum ultraviolet region has continued. The analysis of most of the prominent band systems has been completed, but there are a number of weaker transitions which need more work. In order to be certain of the accuracy of the analysis, a series of spectra of the $C^{13}O$ isotopic molecule has been photographed. These plates are now being measured and analyzed.

   Some preliminary planning has been initiated with respect to possible studies of the emission spectrum of CO in order to clarify the details of some of the states—in particular those which provide only limited information from absorption spectra. If suitable sources can be developed, a search will be made for the, as yet, unobserved transitions $E\,^1\Pi \rightarrow A\,^1\Pi$ and $E\,^1\Pi \rightarrow D\,^1A$.

2. The modified Dewar system for matrix studies of absorption spectra of molecules and radicals in the vacuum ultraviolet region has been placed into operation. A number of experiments have been carried out, with inconclusive results. In particular, mixtures of BrN_3 or ClN_3 in argon have been photolyzed in an effort to produce the BrN and ClN radicals. This operation was carried out under conditions which have been known, from infrared measurements, to produce these species in low temperature matrices. The effect of photolysis was to produce absorption bands in the ultraviolet region—but the bands were broad and lacked sufficient structure to permit a significant identification to be made.

An attempt to photolyze BCl_3, to produce the BCl radical in the matrix, failed when mercury radiation was used as the excitation source. No decomposition of the BCl_3 was detected. When suitable short-wavelength irradiation sources are available (Kr or Xe) resonance lamps) we will again try to carry out this process. These lamps will also be necessary for the photolysis of methane--a research problem which has been mentioned in previous reports.

3. Work on the vacuum ultraviolet flash photolysis of methane--with observation of the kinetics of the CH radical formed in this process--is nearing completion. In addition, the apparatus needed for coupling this experiment to the vacuum spectrograph is nearly completed. When these components are in operation it will be able to monitor the other active species in this process (e.g. CH_2, CH_3, C, etc). It is doubtful, however, that this phase of the program will be underway until after the move of our laboratory to the new NBS facility in Gaithersburg (prior to July 1, 1966).